

VI. A REVIEW OF THE FISHES OF THE FAMILY MUGILIDÆ FOUND IN THE WATERS OF FORMOSA.

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(PLS. XI, XII, AND XIII, FIG. 1.)

The present paper gives an account of the species of fishes belonging to the family *Mugilidæ* found in the waters of the Island of Formosa. It is based on the collections of the author, preserved in the Museum of the Institute of Science of the Government of Formosa, a series also being sent to the Carnegie Museum, including the types of the new species. Of the ten species the four following seem to be new to science:

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| 1. <i>Mugil anpinensis</i> , | 2. <i>Liza formosa</i> , |
| 3. <i>Liza pescadorensis</i> , | 4. <i>Liza parva</i> . |

I am indebted to Dr. David Starr Jordan for help in the preparation of this paper.

Family MUGILIDÆ.

(THE MULLETS.)

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale, so as to form lateral streaks; mouth small, the jaws with small teeth, or none; the teeth, if present, mostly loosely attached, often ciliiform; premaxillaries protractile; gill-openings wide, the membranes separate, free from the isthmus; branchiostegals five or six, gill-rakers long and slender; gills four, a slit behind the fourth; pseudobranchiæ large; two short dorsal fins, well separated, the anterior with four stiff spines, the last one of which is much shorter than the others; second dorsal longer than the first, similar to anal; anal spines usually three (two in the genus *Querimana*) graduated; ventral fin abdominal, not far back, composed of a stiff spine and five rays; caudal forked; air-bladder large, simple; intestinal canal long; peritoneum usually black; vertebræ twenty-four. Genera about ten, species about one hundred, inhabiting fresh waters and coasts of warm regions, feeding on organic matters contained in mud.

KEY TO GENERA FOUND IN FORMOSA.

- a. Anal spines three; stomach gizzard-like. Species marine.
 - a'. Adipose eye-lid well developed, covering at least a third of the iris posteriorly *Mugil*, 1.
 - a''. Adipose eye-lid not developed.
 - b. Upper lip thick, moderately developed *Liza*, 2.
 - bb. Upper lip greatly thickened *Chelon*, 3.

1. Genus MUGIL (Artedi) Linnaeus.

1758. *Mugil* (Artedi) LINNÆUS, Syst. Nat., Ed. X, p. 316. (Type, *Mugil cephalus* LINNÆUS.)

Body oblong, compressed, covered with large cycloid scales. Mouth more or less transverse; the upper lip moderate; anterior margin of the mandible sharp. Both jaws with a few series of small, flexible, ciliiform teeth. Eyes lateral, each with well-developed adipose eye-lid. Stomach gizzard-like. Anal fin slightly longer than the second dorsal.

Distribution: Migratory fishes of all the temperate and tropical regions, often entering rivers. These fishes are known in Japan as *Bora*.

KEY TO FORMOSAN SPECIES OF MUGIL.

- A. Anal fin with eight soft rays.
 - a¹. Median dorsal line not carinated.
 - b¹. Mandibular angle obtuse; extremity of maxillary entirely hidden; adipose eye-lid well developed, covering the iris.
 - c¹. 40-42 scales in a lateral series; depth less than 5 in the total length *cephalus*, 1.
 - c². 38-39 scales in a lateral series; depth more than 6 in the total length *japonicus*, 2.
 - b². Mandibular angle obtuse; extremity of maxillary exposed; adipose eye-lid thin, not covering the iris.
 - c¹. 28 scales in a lateral series *anpinensis*, 3.
 - a². Median dorsal line carinated in front and back of the spinous dorsal.
 - b¹. Mandibular angle obtuse; 38 scales in a lateral series.
 - c¹. *carinatus*, 4.
- B. Anal fin with nine soft rays.
 - d. 33 scales in a lateral series; extremity of maxillary entirely hidden; pectoral nearly as long as head, extending to the spinous dorsal *kelaartii*, 5.

1. *Mugil cephalus* Linnæus.

1758. *Mugil cephalus* LINNÆUS, Syst. Nat., Ed. X, p. 316; Europe.—CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, 1830, p. 307.—GÜNTHER, Cat. Fish., III, 1861, p. 417; Mediterranean: Coast of Madeira; Nile; fresh-water lakes of Tunis; west coast of Africa.—JORDAN & RICHARDSON, Bull. U. S. Bur. Fish., XXVII, 1908, p. 244; Calayan, P. I.—ÔSHIMA, Ann. Carneg. Mus., XII, Nos. 2-4, 1919, p. 268; Taihoku.

Head 3.86 in length; depth 4.42; D. IV-1, 8; A. III, 8; P. 17; V. I, 5; width of head 1.55 in its length; eye 4.23 in head; interorbital space 2; snout 3.50; first dorsal spine 2.20; depth of caudal peduncle 2.66; forty-two scales in a lateral series from gill-opening above to caudal base, thirteen scales in a transverse series counted from vent upward and backward to soft dorsal.

Body robust, elongate, somewhat compressed; dorsal profile nearly straight, ventral profile broadly rounded; head rather small, broad, its top depressed; snout short and obtuse, broadly rounded anteriorly; interorbital space broad, nearly flat; mouth subinferior, slightly oblique, its angle reaching a vertical through posterior nostril; cleft of mouth two times as broad as deep; mandibular angle obtuse; lips thin; lower jaw shorter than the upper, with rather sharp outer edge, symphysis forming a short keel, which fits into the corresponding concavity on the roof of the upper jaw; extremity of maxillary not exposed; both jaws with minute teeth along their outer edges, scarcely visible without lens; eyes anterior, hidden anteriorly and posteriorly by well-developed adipose eyelid; nostrils separated; anterior nostril in a very short tube; posterior nostril slit-like, in front of eye above.

Scales large, cycloid; head scaly, those on the top somewhat enlarged; soft dorsal, anal, and pectoral covered with small scales; base of the caudal fin covered with large scales varying in size; a pointed scaly flap along the base of spinous dorsal.

Origin of spinous dorsal midway between tip of snout and base of caudal; soft dorsal inserted behind the origin of anal, anterior ray the longest; pectoral reaching beyond the origin of ventral, but not reaching the spinous dorsal, inserted above the middle of body; ventral a little nearer the root of pectoral than the spinous dorsal; anal fin opposite the soft dorsal, inserted in advance of the origin of the latter; caudal fin forked.

Color in alcohol grayish above, lower parts silvery; sides with dark

longitudinal stripes along several rows of scales; pectorals, dorsals, and caudal dusky; ventrals and anal whitish.

Length of body 255 mm.

Described from a specimen from Daitôtei Fish Market, Taihoku, collected by Ôshima in March, 1917, and preserved in the Museum of the Institute of Science, Formosa. C. M. Cat. of Fishes, No. 8256.

Habitat: Probably our specimens (three) obtained at the Daitôtei Fish Market were captured at Tamusui near Taihoku.

Remarks: I have little doubt that the present species is true *M. cephalus*, because it agrees quite well with *Mugil cephalus* from Italy in the Stanford University Collections.

The common mullet of Japan, described by several authors under the name *Mugil cephalus*, is distinct from the present species in having a lower body and thirty-eight scales in a lateral series. As it also differs from *Mugil japonicus* Temminck & Schlegel from Nagasaki, covered with ctenoid scales instead of cycloid scales, it is reasonable to give a new name to the former.

2. *Mugil japonicus* Temminck & Schlegel.

Karasumi-bora (Japan); Oahii (Formosa).

1846. *Mugil japonicus* TEMMINCK & SCHLEGEL, Fauna Japonica, Poiss., p. 134, Pl. 72, Fig. 1; Nagasaki.—RICHARDSON, Ichth. China, 1846, p. 247; China.—BLEEKER, Verh. Bat. Gen., XXV, 1853, p. 41; Japan: Act. Soc. Sc. Indo-Neerl., VIII, 1860, p. 59; Borneo; Ned. Tijdschr. Dierk., IV, 1873, p. 143; China; Verh. Akad. Amsterdam, XVIII, 1879, p. 17; Japan.
1911. *Mugil cephalus* TANAKA (not of LINNÆUS), Fishes of Japan, p. 50, Pl. XIII, Figs. 42-45; Japan (one part).—JORDAN, SNYDER, & TANAKA, Journ. Coll. Sci. Tokyo, XXXIII, 1913, p. 113; Japan (one part).
1903. *Mugil oeur* JORDAN & EVERMANN (not of FORSKÅL), Proc. U. S. Nat. Mus., XXV, p. 332; Taihoku, Formosa.—JORDAN & RICHARDSON, Mem. Carneg. Mus., IV, 1909, No. 4, p. 176; Giram, Keelung, Taihoku.—ÔSHIMA, Ann. Carneg. Mus., XII, 1919, Nos. 2-4, p. 270; Formosa.

Head 4.00 in length; depth 4.90; D. IV-1, 8; A. III, 8; P. 16; V. I, 5; width of head 1.50 in its length; eye 4.47; snout 3.24; interorbital space 2.08; first dorsal spine 2.28; first dorsal ray 1.92; third anal spine 3.65; first anal ray 1.92; least depth of caudal peduncle 2.71; thirty-eight scales in a lateral series from gill-opening above to caudal base and three more large ones on the latter; thirteen scales in a

transverse series counted from vent upward and backward to soft dorsal; twenty-two predorsal scales.

Body oblong, elongate, tail very slightly compressed; dorsal profile nearly straight, more or less descending anteriorly, ventral profile strongly curved; head rather small, with depressed top; interorbital space broad, nearly flat; snout short, truncated in front; mouth sub-inferior, oblique, its angle reaching beyond a vertical through the posterior nostril; cleft of mouth one and half times as broad as deep; mandibular angle obtuse; extremity of maxillary not exposed; lower part of anterior and inferior edges of preorbital denticulated; lower jaw slightly shorter than the upper, outer edge rather sharp, with an inner median keel, which fits into the corresponding concavity on the roof of upper jaw; microscopical teeth on both jaws; upper lip fleshy; lower lip thin, distinct at the angle of mouth only; mandible with two pairs of small open glands beneath; eye large, with well-developed adipose eyelid, which covers part of iris anteriorly and posteriorly; nostrils well separated, the anterior a single pore, the posterior slit-like, in front of eye above.

Scales large, cycloid, outer margin rounded, those on the top of head somewhat larger than others, not reaching to tip of snout; a sharply pointed scaly flap along the base of spinous dorsal; pectoral scaly flap rather short and broad; ventral with a sharply pointed scaly flap at the root; a triangular, broad scaly flap between ventral bases; all the fins, except spinous dorsal, covered with minute scales.

Origin of the spinous dorsal a little nearer to tip of snout than base of caudal, first and second spine subequal in length; soft dorsal inserted slightly nearer to origin of spinous dorsal than base of caudal; origin of anal one scale in advance of that of the soft dorsal, much nearer to caudal base than origin of ventral; pectoral inserted above the middle of body, rather short, not reaching to the spinous dorsal; ventral inserted below the apical one-third of pectoral, not reaching half-way to vent; caudal fin forked.

Color dark gray above, belly and lower part of sides silvery; shining dark stripes along several series of scales; pectorals, dorsals, and caudal dusky, the rest of the fins whitish; a black speck at the base of pectoral.

Total length 600 mm.

Described from a male specimen obtained at the Taihoku Fish

Market on Jan. 22, 1921, preserved in the Museum of the Institute of Science, Formosa. C. M. Cat. of Fishes, No. 8279, Tôkô, Dec. 23, 1920. 360 mm. Coll. M. Ôshima.

Habitat: This is one of the most abundant mullets occurring in the waters of Formosa. Our specimens came from Inzampo, Ritakuan, Tôi, and Tamusui of the State of Taihoku; Kwaren River at Kada, and Botansha, Kwarengo; and from Anpin, Takao, and Tôkô.

Remarks: The present species is so closely allied to *Mugil aur* Forskål of the Indian Ocean that it has been referred to the latter by several authors. It is distinct, however, from *M. aur* in having mandibular bones which meet at an obtuse angle, and thirty-eight or thirty-nine scales in a lateral series instead of forty-two to forty-four (according to the description by Francis Day). Moreover, the depth of this species is much less than that of *Mugil aur*, measuring more than six times in the total length.

Another relative of the present species is *Mugil cephalus* of the Mediterranean. It differs from the common Formosan mullet in having a deeper body and more than forty scales in a lateral series.

We refer this species to *Mugil japonicus* Temminck & Schlegel from Nagasaki, separating the latter from the common Japanese mullet regarded as identical with *Mugil cephalus* Linnæus.

This species is very common on the western coast of Formosa. The season for capturing these fishes commences about the middle of November, when they swarm close ashore along the coast of Shinchiku, coming from the western part of the Formosan channel, probably from Fokien, China. At first they migrate to the south along the western coast of the island and return to the north, after depositing their ova somewhere in the high sea near the southernmost cape. They continue very numerous until about the end of February.

The roes are salted and dried to prepare a special caviar, known as "Karasumi" by the Japanese people.

3. *Mugil anpinensis* Ôshima, sp. nov. (Plate XI, fig. 1.)

Anpin-bora (Japan).

Head 4.16 in length; depth 3.40; D. IV-2, 8; A. III, 9; P. 15; V. I, 5; width of head 1.52 in its length; eye 3.50; snout 3.50; interorbital space 2.25; first dorsal spine 1.44; first dorsal ray 1.68; third anal

spine 2.64; first anal ray 1.68; least depth of caudal peduncle 1.76; twenty-eight scales in a lateral series from gill-opening above to caudal base; ten scales in a transverse series from the vent upward and backward to soft dorsal; sixteen predorsal scales.

Body oblong, rather high, slightly compressed posteriorly; dorsal profile convex, from snout to origin of spinous dorsal nearly straight; head subconic; lower jaw not produced; interorbital space broad, more or less arched; eye anterior, moderate; adipose eyelid well developed, but not covering the iris; mouth subinferior, its angle reaching to a vertical through posterior edge of anterior nostril; mandibular angle obtuse; the cleft of mouth nearly three times as broad as deep; symphysis of the mandibular bones forms a small knob, which fits in a depression of the upper jaw; extremity of maxillary exposed; upper lip fleshy; lower lip thin, with sharp edge; no teeth, except a single row of very small ones along the outer part of the upper jaw; lower preorbital edge minutely serrated; nostrils close together, anterior nostril a simple pore in a very short tube, posterior nostril slit-like; isthmus narrow, elongate, somewhat constricted at middle.

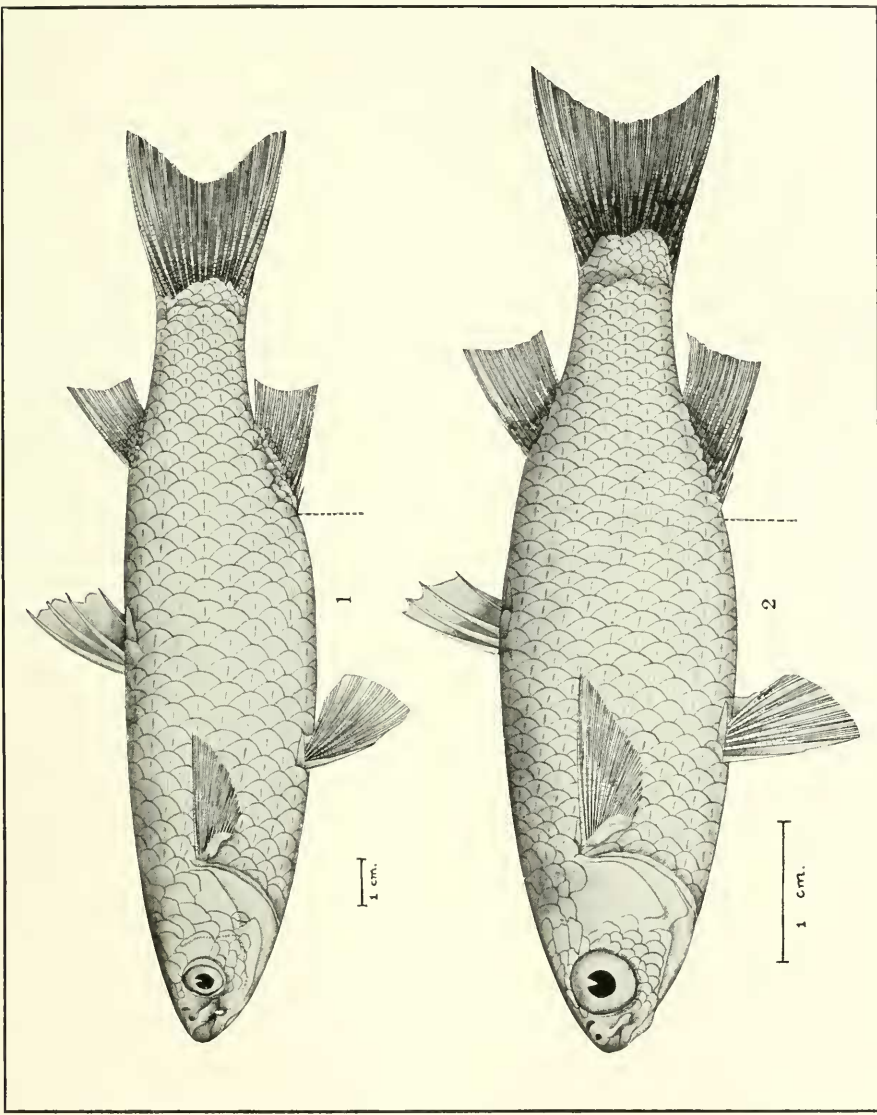
Scales large, round; head scaly, small scales below, larger scales extend forward on snout though not quite to its edge; a sharply pointed scaly flap along the spinous dorsal base; pectoral with no scaly flap; ventral with a sharply pointed scaly flap at the root; a broad scaly flap between ventral bases; soft dorsal, anal, and caudal covered with small scales.

Origin of spinous dorsal midway between tip of snout and base of caudal, first and second spine subequal; soft dorsal inserted nearer base of caudal than origin of spinous dorsal; origin of anal two and one-half scales in advance of that of soft dorsal, nearer to caudal base than the origin of ventral; pectoral rather short, reaching more than half-way to spinous dorsal, inserted in the middle of body above; ventral inserted below the last one-third of the pectoral, not reaching midway to vent.

Color in life bluish gray above, silvery, undersides whitish; spinous dorsal dusky; soft dorsal and caudal finely dusted with dark specks, edge of the latter darker; ventral and anal fins whitish; a dark line along each row of scales on upper three-fourths of body.

Total length 188 mm.

Type: Described from a specimen from Anpin, collected by M.



1. *Mugil nipponensis* Oshima, sp. nov.
2. *Liza parva* Oshima, sp. nov.



Watanabe. In Carnegie Museum. C. M. Cat. of Fishes, No. 8281. Labeled "Type Specimen." Coll. M. Ôshima.

Habitat: Anpin near Tainan (two specimens); Kwaren River at Kada, Kwarenkô (three specimens).

Remarks: The present species is closely related to *Mugil argentus* from South Australia, differing from it in having the extremity of the maxillary extremity exposed; sixteen predorsal scales; the spinous dorsal inserted midway between tip of snout and caudal base.

The figure is taken from a specimen from the Kwaren River, which measured 196 mm. in total length.

4. *Mugil carinatus* (Ehrenberg) Cuvier & Valenciennes.

Sesuji-bora (Japan); Tawah (Formosa).

1830. *Mugil carinatus* (EHRENBURG) CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, p. 148; Red Sea.—DAY, Fish. Brit. India, 1888, Suppl., p. 800; Seas of India.—ÔSHIMA, Ann. Carneg. Mus., XII, 1919, Nos. 2-4, p. 272; Shimo-Tamusui River; Taihoku.

Head 4.01 in length, depth 4.51; D. IV-2, 7; A. III, 9; P. 15; V. I, 5; width of head 1.70 in its length; eye 4.50; interorbital space 2.73; snout 4.00; first dorsal spine 2.18; first dorsal ray 2.00; third anal spine 4.28; first anal ray 2.18; least depth of caudal peduncle 2.18; thirty-eight scales in a lateral series from gill-opening above to caudal base, three more larger ones on the latter; eleven scales in a transverse series from the vent upward and backward to soft dorsal; twenty-eight predorsal scales.

Body oblong, elongate, slightly compressed posteriorly; curvature of dorsal profile weaker than that of the ventral; median dorsal line keeled in front of and behind the spinous dorsal; head subconiform, pointed anteriorly, its top more or less convex; snout narrow and pointed; interorbital space slightly convex; mouth subinferior, nearly horizontal, its angle reaching a vertical through the posterior nostril; cleft of mouth more than two times as broad as deep; mandibular angle obtuse, two small pores on either side beneath; upper jaw protruding beyond the lower; upper lip thick, fleshy; lower lip thin, with sharp edge; symphysis of the mandibular bones forming a small knob, which fits into a depression on the roof of the upper jaw; extremity of maxillary exposed; lower end of pre-orbital finely serrated; no teeth, except a series of microscopical ones along the outer edge of

upper lip; eye large, anterior, with a broad posterior adipose eyelid, nearly reaching the iris; nostrils separated, anterior nostril a single pore in a short tube, posterior nostril slit-like, in front of eye above.

Spinous dorsal inserted much nearer tip of snout than base of caudal, first and second spine subequal in length; soft dorsal inserted midway between origin of spinous dorsal and caudal base, rather short; origin of anal a little in advance of that of the soft dorsal, nearer to caudal base than origin of ventral; pectoral inserted above the middle of body, not extending to the origin of spinous dorsal; ventral inserted below apical one-fifth of the pectoral, not reaching midway to vent; caudal fin forked.

Head and body covered with uniform cycloid scales, outer edge of each scale obtusely pointed; a sharply pointed scaly flap along the spinous dorsal base; pectoral with no scaly flap; ventral fin provided with a sharply pointed scaly flap; a broad scaly flap between ventral bases; soft dorsal, anal, pectoral, and base of caudal covered with minute scales.

Color in life dusky gray above, lower parts whitish, silvery, with no longitudinal stripes along the series of scales; center of each scale somewhat darker; pectorals, dorsals, and caudal dusky; the rest of the fins whitish.

Total length 303 mm.

Described from a specimen from Tainan Fish Market, collected by M. Ôshima on April 20, 1920, and now in the Carnegie Museum. C. M. Cat. of Fishes, No. 8280. (Coll. M. Ôshima.)

Habitat: Many specimens from Tainan Fish Market and Ujuon near Tôkô; a single specimen from Shimo-Tamusui River, and two from Taihoku Fish Market.

Remarks: One of the commonest species of mullets found in Formosa, never reaching a large size.

5. MUGIL KELAARTII Günther.

Nanyo-bora (Japan).

1861. *Mugil kelaartii* GÜNTHER, Cat. Fish. Brit. Mus., III, p. 429; Point de Galle, P. I.—PETERS, Monatsb. Königl. Akad. Wiss. Berlin, 1868, p. 263; Luzon.—FOWLER, Proc. Acad. Nat. Sci. Phila., 1900, p. 500; Sandwich Is.—Proc. Acad. Nat. Sci. Phila., 1903, p. 743; Hawaiian Islands.

Head 4. in length; depth 3.62; D. IV-1, 8; A. III, 9; P. 15; width

of head 1.57 in its length; eye 3.50; snout 4.; interorbital space 2.32; first dorsal spine 2.25; first dorsal ray 1.68; third anal spine 2.47; first dorsal ray 1.64; least depth of caudal peduncle 2.; thirty-three scales in a lateral series from gill-opening above to caudal base; eleven scales counted from the vent upward and backward to soft dorsal; nineteen predorsal scales.

Body compressed, the upper profile weakly curved, gradually descending anteriorly, the curvature of the lower profile stronger than the former; head subconic; interorbital space convex; snout rather short, convex, with a somewhat sharp edge; eye anterior, moderate; adipose eyelid thin, not covering the iris, the posterior lid broader than the anterior; mouth subinferior, slightly oblique, its angle reaching to a vertical through the posterior nostril; upper lip situated obliquely at the lower edge of the snout, rather thin; both jaws with no teeth, edge of the lower thin and sharp; mandibular angle obtuse; the cleft of the mouth two and one-half times as broad as deep; extremity of the maxillary entirely hidden by the pre-orbital, inferior edge of the latter denticulated; isthmus remarkably narrow, distinct only at the middle of the lower jaw; nostrils separated, the posterior larger than the anterior, slit-like, situated in front of eye above.

Scales cycloid, outer margin rounded, with a shallow longitudinal groove; those on the top of head larger and irregular, not extending to the tip of snout; a sharply pointed scaly flap along the base of spinous dorsal, extending backward beyond the base of the fin; pectoral and ventral with a scaly flap; a broad scaly flap between the ventral bases; soft dorsal, anal, and caudal covered with small scales.

Origin of the spinous dorsal midway between the tip of snout and caudal base, first and second spines subequal in length; soft dorsal inserted midway between origin of spinous dorsal and the base of caudal; origin of the anal in advance of that of the soft dorsal, root of the fourth ray corresponds to the origin of the latter; pectoral nearly as long as the head, reaching to the origin of spinous dorsal; ventral inserted below the middle of pectoral, reaching more than half the distance to the vent; caudal forked, tip of each lobe sharply pointed.

Color in alcohol bluish gray above and shining silvery below, with no stripes; a black marking at the root of pectoral; dorsals and caudal dusky, the rest of the fins whitish.

Total length 185 mm.

Described from a specimen from Tôkô, collected by M. Ôshima on Dec. 23, 1920, and preserved in the Museum of the Institute of Science, Formosa. C. M., Cat. of Fishes, No. 8282. 182 mm. Dec. 20, 1920. (Coll. M. Ôshima.)

Habitat: Two specimens from Tôkô.

Remarks: Both specimens from Tôkô are identical with Günther's *M. kelaarti*. An Indian mullet described by Francis Day under the name *M. kelaarti* (Fishes of India, p. 352) differs from the type in having the extremity of the maxillary exposed.

2. Genus LIZA Jordan & Swain.

1884. *Liza* JORDAN & SWAIN, Proc. U. S. Nat. Mus., VII, p. 261. (Type *Mugil capito* Cuvier.)

Body robust, more or less oblong and compressed. Head and body covered with large scales. Mouth subinferior, more or less transverse; upper lip not much enlarged; teeth movable, ciliiform, sometimes obsolete; anterior margin of mandible thin and sharp. Eyes without adipose eyelid. First dorsal consisting of four stiff spines; anal opposite the soft dorsal, slightly longer than the latter, with three spines. This genus differs from *Mugil* mainly in the absence of the adipose eyelid.

Distribution: British and Scandinavian coast; Canary Islands; Mediterranean; Nile; fresh-water lakes of Tunis; from Red Sea through Indian Ocean and Archipelago to the coasts of Australia and Polynesia; India; Ceylon; Philippine Islands; Indo-China; Formosa; Riu Kiu Islands; Japan.

KEY TO FORMOSAN SPECIES OF LIZA.

a¹. The upper lip not notably thickened.

b¹. 39-40 scales in a lateral series; extremity of maxillary not exposed.
formosa, 6.

b². 30-33 scales in a lateral series.

c¹. Extremity of maxillary not exposed; nostrils separated; origin of spinous dorsal a little nearer to caudal base than tip of snout.
parva, 7.

c². Extremity of maxillary exposed; nostrils close together.

d¹. Mandibular angle obtuse; the cleft of mouth three and one-half times as broad as deep; origin of spinous dorsal midway between tip of snout and base of caudal... *pescadorensis*, 8.

- d*². Mandibular angle obtuse; the cleft of mouth three times as broad as deep; origin of spinous dorsal nearer to base of eye 4.28; first dorsal spine 2.23; first dorsal ray 1.64; third anal spine 3.50; first anal ray 1.75; least depth of caudal peduncle 2.23; forty scales (thirty-nine scales on the right) in a lateral series from gill-opening above to caudal base, three more scales on the latter; thirteen scales in a transverse series from the vent upward and backward to soft dorsal; about twenty predorsal scales.

6. *Liza formosæ* Ôshima, sp. nov. (Plate XII, fig. 2.)

Taiwan-menada (Japan).

1865. *Mugil suppositus* DAY, Fishes of Malabar, p. 143; Seas of Malabar and Malaysia; Cochin (not of GÜNTHER).

Head 3.64 in length; depth 3.33; D. IV-2, 7; A. III, 9; P. 16; V. I, 5; width of head 1.50 in its length; snout 3.37; interorbital space 2; eye 4.28; first dorsal spine 2.23; first dorsal ray 1.64; third anal spine 3.50; first anal ray 1.75; least depth of caudal peduncle 2.23; forty scales (thirty-nine scales on the right) in a lateral series from gill-opening above to caudal base, three more scales on the latter; thirteen scales in a transverse series from the vent upward and backward to soft dorsal; about twenty predorsal scales.

Body oblong, rather high, slightly compressed posteriorly; dorsal and ventral profiles equally convex; head broad, rounded anteriorly; a slight ridge from the upper surface of orbit to the pectoral base; interorbital space more or less convex, rather broad; snout short, not truncated in front; mouth subinferior, transverse, the cleft four times as broad as deep, its angle reaching a vertical through the posterior nostril; mandibular angle markedly obtuse; upper jaw rounded, a little longer than the lower, with a depression in its inner center, receiving a knob on the lower jaw; upper lip fleshy, lower lip thin, distinct only at the angle of mouth; isthmus extremely narrow, elongate; no teeth in the lips; extremity of maxillary entirely hidden; both the anterior and lower edges of pre-orbital denticulated; eye rather small, anterior, with no adipose eyelid; nostrils separated, anterior nostril a single pore in a short tube, posterior nostril slit-like, midway between the former and orbit above.

Head and body covered with uniform cycloid scales, those on the top of head somewhat larger and irregular; outer margin of each scale rounded; a fine longitudinal groove on all the scales, except those on head; a scaly flap along the base of spinous dorsal sharply pointed, elongate, extending backward beyond the base of the fin; pectoral and ventral with a sharply pointed scaly flap; a broad scaly

flap between ventral bases; basal part of pectoral, soft dorsal, anal, and caudal fins covered with minute scales.

Origin of spinous dorsal midway between tip of snout and base of caudal, rather tiny, its first three spines subequal in length, inserted close together, the third somewhat shorter, the fourth spine much weaker and shorter; soft dorsal inserted much nearer to spinous dorsal than base of caudal, the distance between two dorsals equal the length of anterior margin of soft dorsal; anal slightly in advance of the origin of soft dorsal, third spine half as long as the first ray, the last ray divided into two; upper margin of pectoral in the upper third of body, shorter than the head, scarcely reaching the origin of spinous dorsal; ventrals rather short, extending midway to vent; caudal fin forked in its posterior third.

Color in alcohol dusky gray above, whitish and silvery below; body with longitudinal stripes along the series of scales; first and second dorsals, caudal, anal, and pectoral yellowish, minutely dotted with black; ventral whitish; a black speck superiorly at the base of pectoral.

Total length 126 mm.

Type: Described from a single specimen from Anpin, collected by M. Watanabe on Nov. 6, 1919, and preserved in the Carnegie Museum, Cat. of Fishes, No. 8283. 126 mm. (M. Watanabe, Coll.)

Habitat: Anpin near Tainan.

Remarks: In the year 1865 Francis Day described a small mullet from the Seas of Malabar under the name *Mugil suppositus* in his paper entitled "The Fishes of Malabar." It is quite different, however, from Günther's *M. suppositus*, because the latter is provided with eight anal rays, the last of which is split to its base, while the form under consideration has nine soft rays, the last of which is distinctly divided into two at the base.

The present species is identical with Day's *M. suppositus*, distinctly differing from the form so named by Günther in having the maxillary entirely covered by the pre-orbital and nine soft dorsal rays. It is necessary, therefore, to give a new name to it, Day's *M. suppositus* being regarded as identical.

7. *Liza parva* Oshima, sp. nov. (Plate XI, fig. 2.)

Hime-menada (Japan); Shoahii (Formosa).

Head 3.73 in length; depth 3.35; D. IV-1, 8; A. III, 9; P. 15; V. I, 5; width of head 1.78 in its length; snout 3.75; eye 3.20; interorbital space 2.67; first dorsal spine 1.78; first dorsal ray 1.60; third anal spine 2.50; first anal ray 1.67; least depth of caudal peduncle 2.29; pectoral 1.14; ventral 1.50; thirty-three scales in a lateral series from gill-opening above to caudal base and three more large ones on the latter; eleven scales from the vent upward and backward to the soft dorsal; eighteen predorsal scales.

Body rather high, strongly compressed, deepest at the origin of spinous dorsal; dorsal profile convex, gradually descending anteriorly, ventral profile much more convex than the former; head small, subconiform; snout short, rather broad, truncated in front; interorbital space more or less convex; eye moderate, anterior, with no adipose eyelid; mouth subinferior, its angle reaching a vertical through anterior border of posterior nostril, the cleft three times as broad as deep; mandibular angle obtuse, symphysis forming a small knob, which fits into a depression above; extremity of maxillary entirely hidden; teeth none on both jaws; upper lip fleshy; lower lip thin, with sharp edge; lower pre-orbital edge finely serrated; nostrils separated, the anterior a simple pore, nearer to extremity of snout than orbit, the posterior slightly larger than the former, semilunar, with a cutaneous membrane, situated midway between anterior nostril and orbit above; isthmus elongate, lanceolate, slightly constricted at middle.

Scales in an even longitudinal series, rather thin, round; head scaly, smaller scales below, extending forward on snout though not quite to its edge; a sharply pointed scaly flap along the spinous dorsal base; pectoral with a short scaly flap; a slender pointed scaly flap at the root of ventral; a broad scaly flap between ventral bases; base of the soft dorsal, anal, and caudal covered with small scales.

Origin of the spinous dorsal a little nearer base of caudal than tip of snout, first and second spines subequal in length; soft dorsal inserted nearer origin of spinous dorsal than the base of caudal; origin of anal two scales in advance of that of the soft dorsal, midway between caudal base and origin of ventral; pectoral elongate, scarcely reaching to the origin of spinous dorsal, inserted in the middle of body

above; ventral inserted below the middle of pectoral, reaching beyond midway to vent.

Color in alcohol slaty above, lower part silvery; spines and rays of dorsal fins minutely speckled with black, the fin-membranes whitish; caudal fin more or less dusky, with darker edge; pectoral, ventral, and anal fins whitish.

Total length 70 mm.

Type: Described from a specimen from Anpin, collected by M. Watanabe, and preserved in the Carnegie Museum, Cat. of Fishes, No. 8284. 70 mm.

Habitat: Six specimens were obtained at Anpin near Tainan, all mature, with ripened ovaries and testes; and numerous examples from Tôkô at the estuary of the Shimo-Tamusui River.

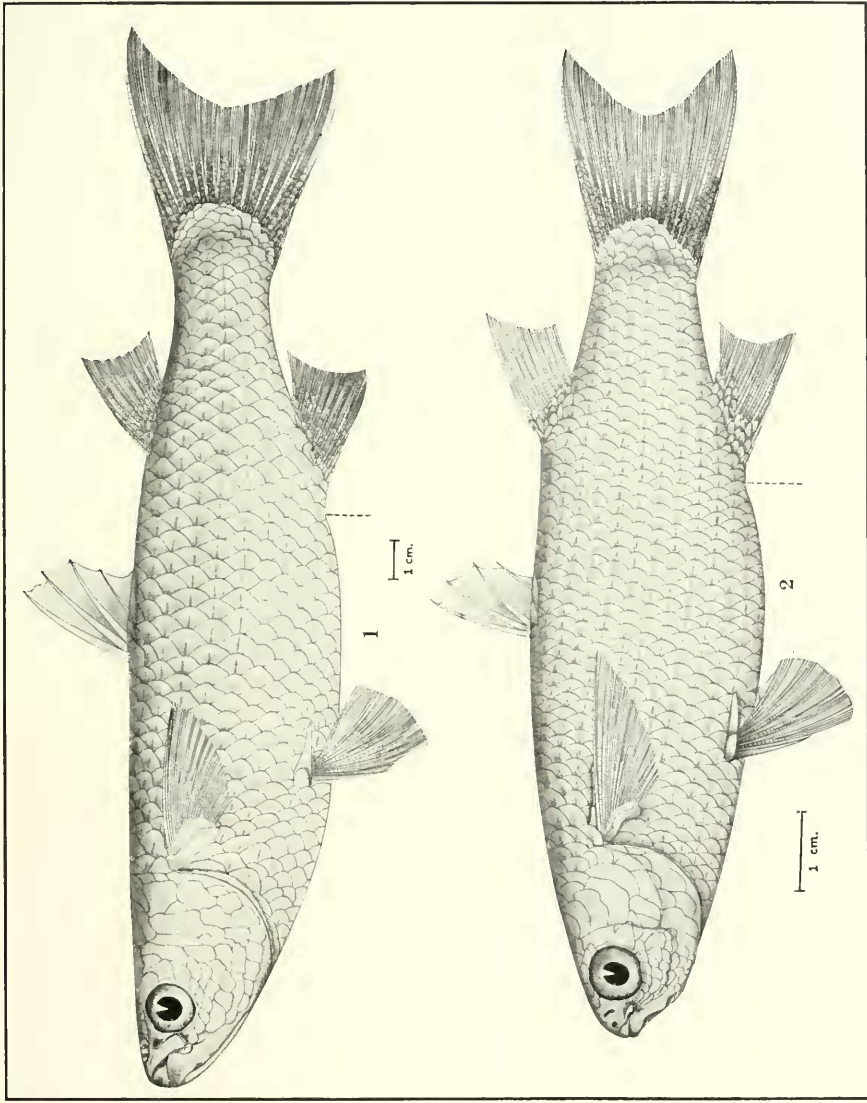
Remarks: The present species is closely allied to *Liza troscheli*, differing from it, however, in having the maxillaries not exposed and the nostrils separated.

8. *Liza pescadorensis* Ôshima, sp. nov. (Plate XII, fig. 1.)

Taiwan-bora (Japan).

Head 3.96 in length; depth 4.11; D. IV-1, 8; A. III, 9; P. 16; V. I, 5; width of head 1.44 in its length; snout 3.59; eye 4.38; interorbital space 2.20; first dorsal spine 1.65; first dorsal ray 1.93; third anal spine 3.; first anal ray 2.28; least depth of caudal peduncle 2.33; pectoral 1.40; ventral 1.75; thirty-three scales in a lateral series from gill-opening above to caudal base and four more large ones on the latter; ten scales in a transverse series from the vent upward and backward to soft dorsal; twenty predorsal scales.

Body elongate, compressed posteriorly; dorsal profile nearly straight, very slightly descending anteriorly, ventral profile convex; deepest at the origin of spinous dorsal; head rather robust, lower surface more or less constricted below eye; lower surface much more inclined than the superior; snout quadrate, rather broad; interorbital space flattened, nearly straight; eye large, anterior, with no adipose eyelid; mouth subinferior, the cleft three and one-half times as broad as deep, its angle scarcely reaching a vertical through the anterior border of the anterior nostril; mandibular angle remarkably obtuse, symphysis forming a small knob, which fits into a depression above; ex-



1. *Liza pescadorensis* Oshima, sp. nov.
2. *Liza formosæ* Oshima, sp. nov.

tremity of maxillary exposed; teeth none, except a single series of minute ones along the extremity of upper lip; upper lip rather fleshy; lower pre-orbital edge finely denticulate; isthmus narrow, elongate, slightly constricted at middle, lanceolate; nostrils close together, anterior nostril a simple pore with slight cutaneous rim; posterior nostril much larger than the former, widely opened.

Scales moderate, in an even longitudinal series, mostly uniform; head scaly, smaller scales below, large scales extend forward on snout, though not quite to its edge; a scaly pointed flap along the spinous dorsal base; pectoral fin with no scaly flap; axillary scaly ventral flap two in the fin, sharply pointed; a broad scaly flap between ventral bases; soft dorsal, anal, and caudal covered with minute scales.

Origin of spinous dorsal midway between tip of snout and base of caudal, first and second spine subequal in length; soft dorsal inserted midway between origin of spinous dorsal and base of caudal; origin of anal two scales before that of the soft dorsal, much nearer caudal base than the ventral origin; caudal fin deeply forked, upper lobe somewhat longer than the lower; pectoral rather short, inserted above the middle of the body; ventral inserted about opposite last third in pectoral, not reaching half way to vent.

Color in alcohol bluish gray above, whitish below, silvery; spinous dorsal dusky; soft dorsal, anal, and caudal uniformly dusted with dusky specks, edge of the latter somewhat darker; pectoral more or less dusky; ventral whitish; body with no distinct dark stripes along each row of scales.

Total length 275 mm.

Type: Described from a specimen from Bakô, Pescadores Islands, collected by M. Ôshima on June 5, 1920, and now in the Carnegie Museum, Cat. of Fishes, No. 8285.

Habitat: Our specimens came from Pescadores Islands and Tôkô, a small town in the southernmost part of Formosa.

Remarks: The present species is very closely allied to *Liza smithi* from the Cape of Good Hope, differing from it in having ten scales in a transverse series instead of eleven to twelve.

9. *Liza troscheli* (Bleeker).

Kobora (Japan).

1858. *Mugil troscheli* BLEEKER, Nat. Tijdschs. Ned. Ind., XVI, p. 277.—Act. Soc. Sc. Indo-Neerl., VIII, 1860, p. 80; Sumatra.—GÜNTHER, Cat. Fish., III, 1861, p. 448; Coast of Java, Borneo, and Ceylon.—DAY, Fish. Brit. India, 1878, p. 358; Indian Sea to Malay Archipelago.—RUTTER, Proc. Acad. Nat. Sci. Phila., 1897, p. 70; Swatow.
1903. *Liza troscheli* JORDAN & EVERMANN, Proc. U. S. Nat. Mus., XXV, p. 332; Hókotó, Formosa.—JORDAN & SEALE, Bull. U. S. Bur. Fish., XXVI, 1906, p. 11; Cavite, P. I.—JORDAN & RICHARDSON, Bull. U. S. Bur. Fish., XXVII, 1908, p. 244; Iloilo.—SMITH & SEALE, Proc. Biol. Soc. Wash., XIX, p. 76; Mindanao.—SEALE & BEAN, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 240; Zamboanga.—JORDAN & RICHARDSON, Mem. Carneg. Mus., IV, No. 4, 1909, p. 176; Takao; Hókotó, Formosa.—SNYDER, Proc. U. S. Nat. Mus., XXXII, 1912, p. 495; Okinawa.—JORDAN & STARKS, Ann. Carneg. Mus., XI, Nos. 3 & 4, 1917, p. 439; Ceylon.—ÔSHIMA, Ann. Carneg. Mus. XII, 1919, Nos. 2-4; Sobun R.; Hókotó; Takao, Formosa.

Head 4 in length; depth 4.06; D. IV-2, 7; A. III, 9; P. 15; V. I, 5; width of head 1.31 in its length; eye 4; snout 3.42; interorbital space 2.27; first dorsal spine 1.79; first dorsal ray 2.; third anal spine 3.33; first anal ray 1.79; thirty-two scales in a lateral series from gill-opening above to caudal base, and three more large ones on the latter; ten scales in a transverse series from the vent upward and backward to soft dorsal; about twenty predorsal scales.

Body oblong, compressed posteriorly, the ventral profile much more curved than the dorsal, the profile between tip of snout and spinous dorsal slightly convex, gradually descending anteriorly; deepest at the origin of spinous dorsal; head rather small, top more or less convex; snout quadrate, truncated in front; interorbital space rather broad, slightly convex; upper jaw longer than the lower; mouth subinferior, slightly oblique, its angle reaching a vertical through the posterior border of the anterior nostril; the cleft three times as broad as deep; mandibular angle obtuse; extremity of maxillary exposed; upper lip fleshy, with a series of minute teeth along the outer edge; lower jaw with no teeth, its outer edge thin and sharp; a depression in the upper jaw receiving a small knob on the symphysis of the lower jaw; lower external edge of the pre-orbital finely denticulated; isthmus very narrow, elongate; eye moderate, with no adipose eyelid; nostrils close together, the anterior a simple pore in a very short tube, the posterior slit-like, a little larger.

Origin of spinous dorsal nearer to base of caudal than tip of snout, anterior three spines inserted close together, the first and second subequal in length; soft dorsal inserted nearer base of caudal than origin of anal; origin of anal three scales in advance of that of the soft dorsal, much nearer to base of caudal than origin of ventral; pectoral inserted above the middle of body, rather short, not reaching the spinous dorsal; origin of ventral below the last third of the pectoral, not reaching half way to vent; caudal fin forked at the apical one-third.

Head and body covered with large cycloid scales, outer edge of each scale obtusely pointed; scales on the top of the head somewhat larger and irregular, not reaching the tip of snout; a sharply pointed scaly flap along the base of spinous dorsal; pectoral with no scaly flap; ventral with a sharply pointed scaly flap, a broad scaly flap between ventral bases; soft dorsal, anal, basal part of pectoral, and caudal covered with small scales.

Color in alcohol dusky gray above, lower parts white, silvery; ventrals whitish; the rest of the fins dusky.

Total length 257 mm.

Described from a specimen from Bakô, Pescadores Islands, collected by Ôshima on June 2, 1920, and now in the Carnegie Museum, Cat. of Fishes, No. 8286. 257 mm.

Habitat: Our specimens came from Sobun River near Tabani; Tôkô; Takao; Buraku River; Akô; and Pescadores Islands. One of the commonest mullets in Formosa.

Genus CHELON Röse.

1793. *Chelon* RÖSE, Petri Artedi Angermannia Sueci Synonymia Nominum Piscium, Editio II, p. 118. Type *χελών* Aristotle, *Mugil chelo* Cuvier and Valenciennes.

1863. *Chanomugil* GILL, Proc. Acad. Nat. Sci. Phila., XV, p. 169. Type *Mugil proboscideus* Günther.

This genus, as here understood, agrees with *Liza* in the absence of the adipose eyelid, differing, however, in the greatly thickened upper lip, which, in typical species, at least, is fringed on the edge and covered with flat, flexible teeth. Further comparative studies are necessary before we can be sure that *Chanomugil* is identical with *Chelon*, and the Formosan species may be generically distinct from both.

10. *Chelon crenilabis* (Forskål). (Plate XIII, fig. 1.)

Boko-menada (Japan).

1775. *Mugil crenilabis* FORSKÅL, Descr. Anim., p. 73.—CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, 1828, p. 123.—GÜNTHER, Cat. Fish. Brit. Mus., III, 1861, p. 458; Red Sea.

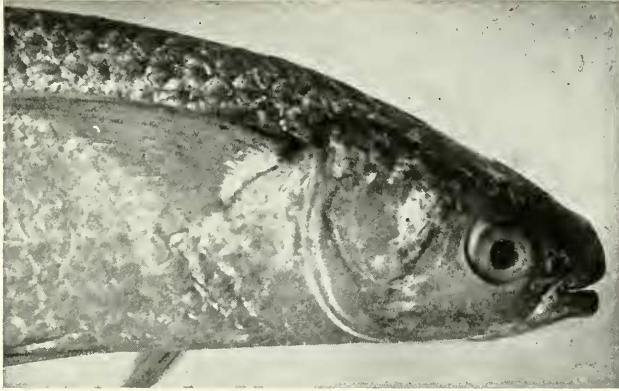
1828. *Mugil fasciatus* CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, p. 125.

Head 4. in length; depth 3.53; D. IV-2, 7; A. III, 9; P. 16; V. I, 5; width of head 1.46 in its length; snout 2.83; interorbital space 2; eye 4.52; first dorsal spine 2.; first dorsal ray 1.64; third anal spine 3.; first anal ray 1.53; least depth of caudal peduncle 1.92; forty scales in a lateral series from gill-opening above to caudal base, three more large scales on the latter; twelve scales in a transverse series from vent upward and backward to the soft dorsal; about twenty-one predorsal scales.

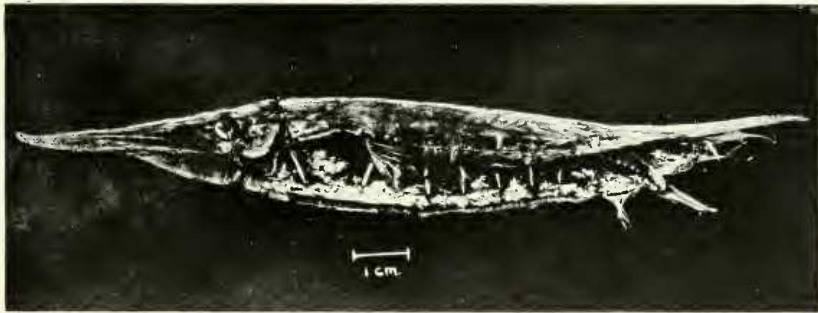
Body oblong, rather high, slightly compressed posteriorly; dorsal and ventral profiles equally convex; head subconiform, upper surface more or less convex; interorbital space rather broad; snout short, truncated in front; mouth terminal, transverse, the cleft four times as broad as deep, its angle reaching to a vertical through the posterior nostril; mandibular angle obtuse; upper lip remarkably thick, granulated, with small fleshy fringes along its edge, inferior part whitish; lower lip rather thin, outer edge fringed; depression of the upper jaw shallow, receiving a small knob at the symphysis of the lower jaw; extremity of maxillary entirely hidden by pre-orbital, inferior edge of the latter denticulated; isthmus very narrow, elongate; eye moderate, anterior, with no adipose eyelid; nostrils separated, the posterior slit-like, situated midway between the anterior nostril and orbit above.

Head and body covered with uniform cycloid scales, those on the top of head somewhat larger and irregular; a fine longitudinal groove on the scales on the body; a sharply pointed scaly flap along the base of spinous dorsal, extending backward beyond the base of the fin; pectoral and ventral with a pointed scaly flap; a broad scaly flap between ventral bases; soft dorsal and anal scaly; proximal part of the caudal covered with small scales.

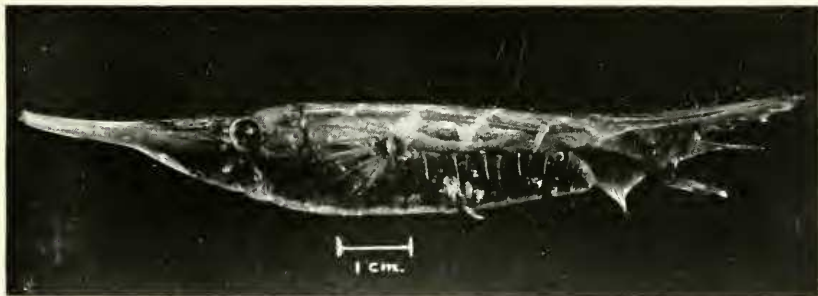
Origin of spinous dorsal nearer tip of snout than caudal base, first spine the longest, fourth spine rather tiny; soft dorsal inserted much



1



2



3

1. *Chelon crenilabis* (Forskål).
2. *Centriscus scutatus* Linnæus.
3. *Centriscus capito* Oshima, sp. nov.

nearer to the spinous dorsal than caudal base, the distance between two dorsals much longer than the length of anterior margin of soft dorsal; anal inserted slightly in advance of the origin of soft dorsal, third spine nearly half as long as the first ray; pectoral inserted in the middle of the body above, not reaching the origin of spinous dorsal; ventrals rather short, extending beyond half-way to vent; caudal fin forked, tip of each lobe sharply pointed.

Color in alcohol uniformly dusky gray above, whitish and silvery below; upper two-thirds of the upper lip gray; a black spot superiorly at the base of pectoral; all the fins except ventrals dusky.

Total length 258 mm.

Described from a specimen from Pescadores Islands, collected by M. Ôshima on September 15, 1920. [This example seems to agree fully with the account of *Mugil crenilabis* as given by Cuvier and Valenciennes. It is not, however, a true *Mugil*, and it may prove the type of a genus distinct from *Chclon*.—D. S. JORDAN.]

Habitat: Pescadores Islands¹ (a single specimen).

¹ The "Pescadores Islands" here mentioned, are a small group west of Formosa, and not to be confounded with other groups of the same name.—Ed.